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## CALCULUS.

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81. Proposed by J. OWEN MAHONEY, B. E., M. Sc., Graduate Fellow in Mathematics in Vanderbilt University, Carthage, Texas.

Solve :  $y^2(d^2y/dx^2) + a(dy/dx)^2 = bx.$

82. Proposed by ALOIS F. KOVARIK, Instructor in Mathematics and Physics, Decorah Institute, Decorah, Ia.

A pole 60 feet high stands vertically in a river 20 feet deep. How many feet above the surface of the water must it break so that the top bending down would touch the bottom and the distance on the surface of water between the points where the parts of the pole enter the water would be maximum?

\*\*\* Solutions of these problems should be sent to J. M. Colaw not later than December 10.

## MECHANICS.

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75. Proposed by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

A particle,  $P$ , is held in a bent tube by two forces directed towards two fixed points,  $H$  and  $S$ . Show that the equation to the form of tube is  $PS \cdot PH = k^2$ , if the forces are  $\mu/PS$  and  $\mu/PH$ .

76. Proposed by J. F. LAWRENCE, Classical Sophomore, Drury College, Springfield, Mo.

An inclined plane of mass  $M$  is capable of moving freely on a smooth horizontal plane. A perfectly rough sphere of mass  $m$  is placed on its inclined face and rolls down under the action of gravity. If  $x'$  be the horizontal space advanced by the inclined plane,  $x$  the part of the plane rolled over by the sphere, prove that  $(M+m)x' = mx \cos \alpha$ ,  $\frac{7}{8}x - x' \cos \alpha = \frac{1}{2}gt^2 \sin \alpha$ , where  $\alpha$  is the inclination of the plane. [From *Routh's Elementary Rigid Dynamics*, page 126.]

\*\*\* Solutions of these problems should be sent to B. F. Finkel not later than December 10.

## DIOPHANTINE ANALYSIS.

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74. Proposed by O. W. ANTHONY, M. Sc., Instructor in Mathematics, Boys' High School, New York City.

Solve

$$x^2 + y^2 = a^2,$$

$$z^2 + w^2 = b^2,$$

$$y^2 + w^2 = d^2, \text{ i. e. obtain values of } x, y, z, w,$$

which will make the second members perfect squares.

75. Proposed by CHARLES CARROLL CROSS, Libertytown, Md.

(1). In how many ways can the consecutive integers 1 to 16 be arranged as a Magic Square?

(2). Arrange the consecutive integers 1 to  $n^2$  as a Magic Square, where  $n$  is odd. Apply when  $n=9$ .

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